rules its destinies, as the spirit in the wheels. Keep in mind, however, that there are not two things, the spirit and the wheels, but there is one reality. The cosmic order conceived as the norm of all motions is the spirit, and the details of its actualization are the wheels. Every detailed piece of its mechanism is a direct manifestation of the spirit.

HENRI POINCARE ON THE RELATIVITY OF SPACE.

Whether or not the theories of Henri Poincaré will live long after him is a question of doubt, but it is certain that his method of presenting mathematical problems is very ingenious and attractive. In his article on "The Relativity of Space" we find him grappling with difficulties which are of his own making. But even though we may disagree we follow him with a real satisfaction at the beauty not only of his style but of his very thought and the method by which he reaches his conclusions.

According to our definition space is relativity itself; space being the scope of motion is the condition of tracing distances, and what is distance but the measurable relation of position? In order to do any measurement in space at all we must start in some definite place and consider it as fixed. It serves us as a point of reference. But if we omit to do this, we become involved in a confusion like that of a dizzy man who cannot clearly mark or maintain the direction of his walk. Yet on the basis of this omission of a definite starting-point of reference, M. Poincaré has succeeded with his traditional consideration of the change of the site of the Pantheon in cosmic space, in producing beautiful kaleidoscopic reflections and cogitations on the relativity of space. It is by the same method that Herbert Spencer in omitting to start his space measurements from a reference point derived the notion of the absolute inscrutability of space.[1]

Poincaré's views of space are based ultimately and exclusively on experience, and it seems as if he had forgotten Kant or had never heard of his conception of the *a priori*. We too believe that the idea of mathematical space is derived in its completeness from sense-experience; we believe that only a generalization of a scope of motion, a highly abstract idea of extension with the omission of all particular existences constitutes the basis of space conceptions, and we can construct different kinds of spaces by different modes

[1] See Carus, *Kant and Spencer*, pp. 57-59.

of procedure. All these different spaces are *a priori,* the most complicated as well as the simplest, the one which recognizes parallels in which all lines would meet somewhere at some distances. Our Euclidean geometry does not depend on the constitution of our universe and least of all upon sense-experience but is simply one *a priori* construction among many others. We prefer it because it is the simplest one. It would be by no means impossible to make our computations of the starry heavens on the basis of geometrical construction in curved space, but I fear we shall find no astronomer who would allow himself to be handicapped by the difficulties of a gratuitous curvature when rectilinear figures in their simpler construction are available.

Many incidental remarks in Poincaré's views may be criticised. He condemns such terms as "absolute space" and "distance in itself." He claims that absolute space is meaningless and distance in itself does not exist. We grant both, but would it not be best before condemning these terms to wait until some one uses them and offers us his definition? Newton, for instance, speaks of absolute space and defines it. Though the expression is rather unfortunate we know very well what he meant by it, and we can let it go without assuming that Newton's absolute space is a contradiction or a metaphysical and mystical idea which only betrays a lack of critical acumen in the man who uses it.

A change in size will by no means, as M. Poincaré declares, remain unnoticed or leave everything unaltered. The relation between the radius and the volume of a sphere changes with its size, and the change would produce noticeable results. There is a certain size in which the living cell can maintain its equilibrium and carry out its life functions to greatest advantage, and the same seems to be true of the size of planets. The same is true *mutatis mutandis* in changes by deformation as for instance the reflections in curved mirrors, but though Poincaré's examples are not applicable we are fascinated by his suggestive way of treating the problem and wonder at the poetic method by which he shows us a space mixed up with elements that represent the three dimensions in separate portions closely interspersed and overlapping one another. We find it difficult to follow him when he says that "the property of space as having three dimensions is only a property of our table of distribution" which is in "the form of a table of triple entry," and is "an internal property of the human intelligence, so to speak."

Poincaré deduces from the definition of space itself "a certain

indeterminateness," and he thinks that it is "precisely this indetermination which constitutes its relativity." Without entering into a discussion of this mooted point it seems to us that the indetermination of space is of Poincaré's own making, while the relativity of space being inherent in the very nature of space is quite independent of it.

P. C.